



*IT Chief Technology and Innovation Office (org 176)*

# **NASA JPL: Small Satellite Data Science Pilot**

*Advanced IT Research and Open Source Projects Office (1761)*

*NASA NEPP ETA 2018 Workshop*

*NASA GSFC*

*June 2018*





# Information about small satellites is distributed across disparate resources

## NASA

**SPOON**  
SMALLSAT PARTS ON ORBIT NOW

**Approved Suppliers List**

Search My Favorites Reports Contacts Links About Admin

Basic Search Quick Approved Supplier Search Clear Advanced Search

Record(s) found = 0 Compare Suppliers Export to Excel

Compare	Supplier	Approval Scope	View

**PARS** Parts Acquisition and Review System

NASA Jet Propulsion Laboratory | California Institute of Technology | CubeSat

**Missions**

ASTERIA CIRAS CubeRRT

## Industry

**satsearch**

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Categories: Antenna, Battery, Power, Separation system, Solar panel, Structure, Thruster

World's largest selection of space parts at your fingertips!

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## Academic

**Small Satellite Conference**  
small SATELLITE

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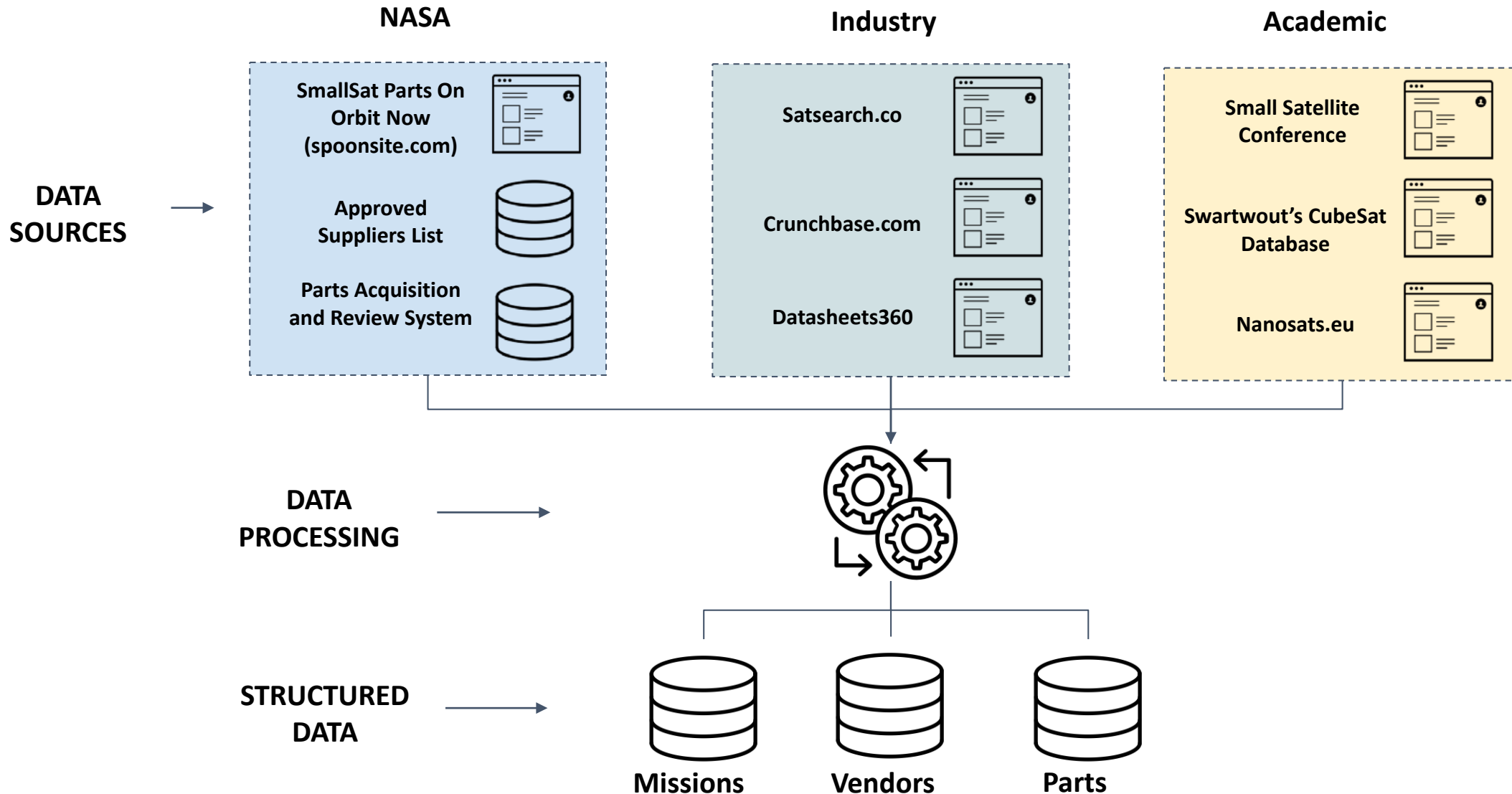
World's largest database of nanosatellites and CubeSats

Register now for access to exclusive benefits and tools!

**NANOSATELLITE & CUBESAT DATABASE**

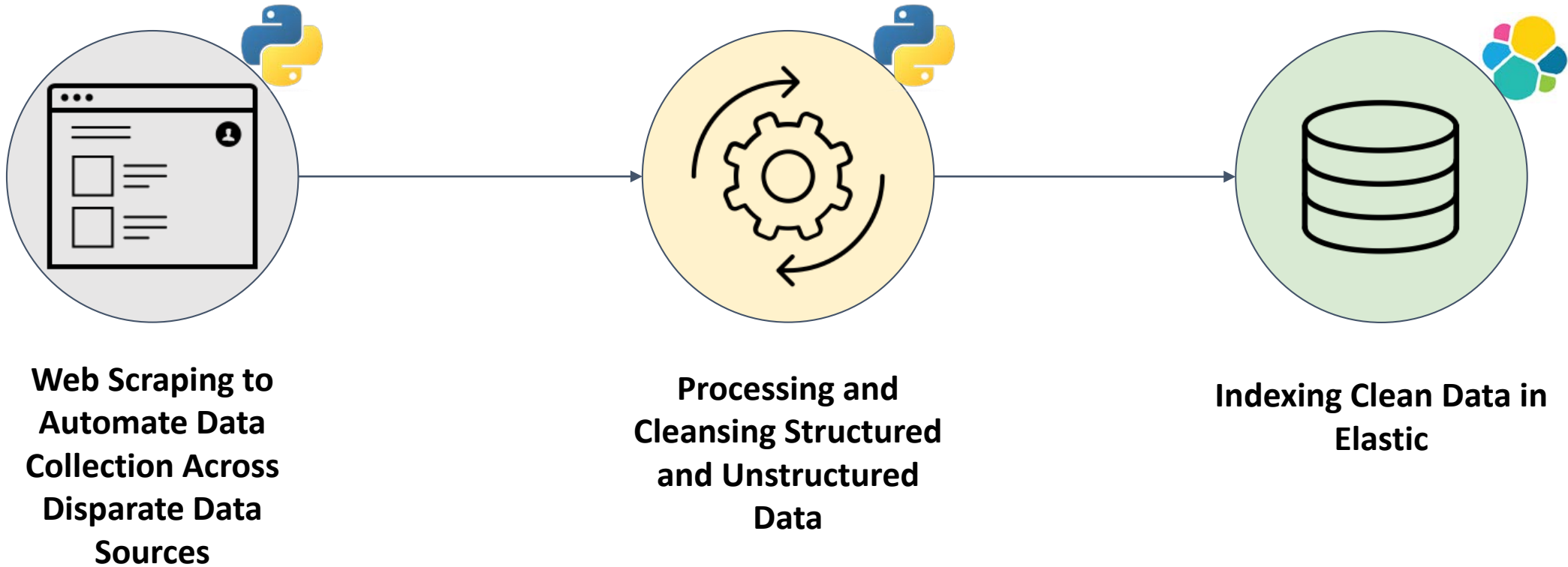
Mission name	Organization	Launch date	Status	Mission description
Tubert-1	Thales	2010-01-27	Success	Thales' first nanosatellite mission, launched from the French Guiana Space Center. It was the first nanosatellite to be launched from the French Guiana Space Center.
Tubert-2	Thales	2010-01-27	Success	Thales' second nanosatellite mission, launched from the French Guiana Space Center. It was the first nanosatellite to be launched from the French Guiana Space Center.

# Data Collection Process Overview



# Web Scraping Content

Cubesats.org, Swartout Cubesat DB, etc.



# NEPP SmallSat Supplier Task History

- **2015-2016 (Beckwith/Smith)**

- Survey of 5 SmallSat Suppliers (integrators and product providers)
  - 5 Questions
  - Quality criteria based on ISO9001 standards
- Database of NASA and JPL EEE parts usage on smallsats

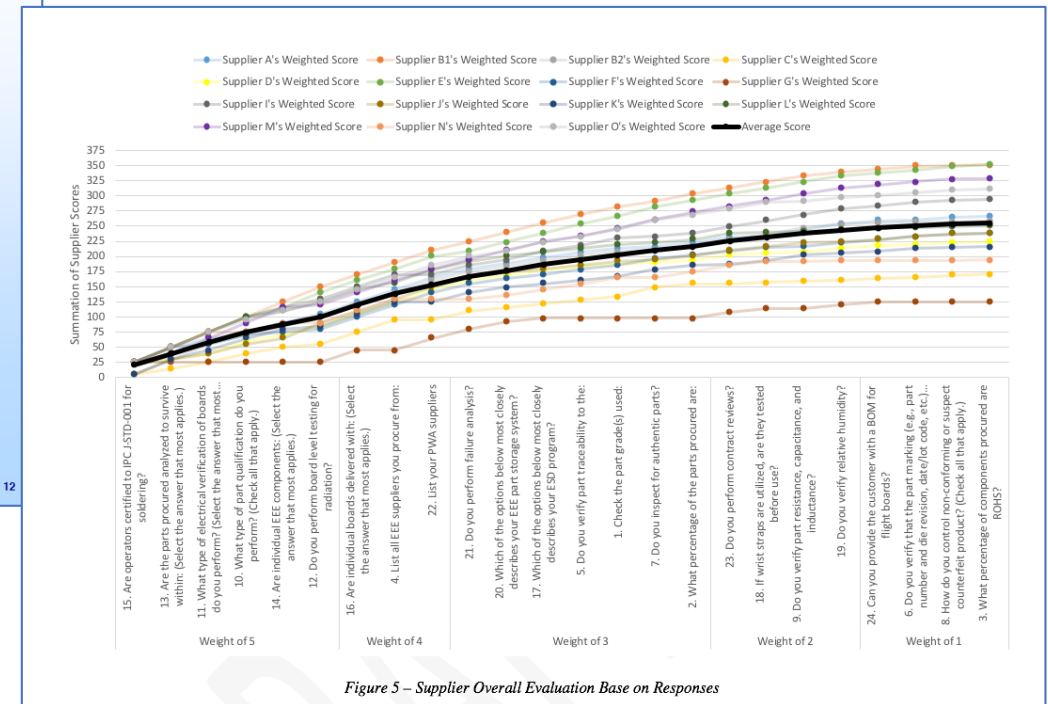
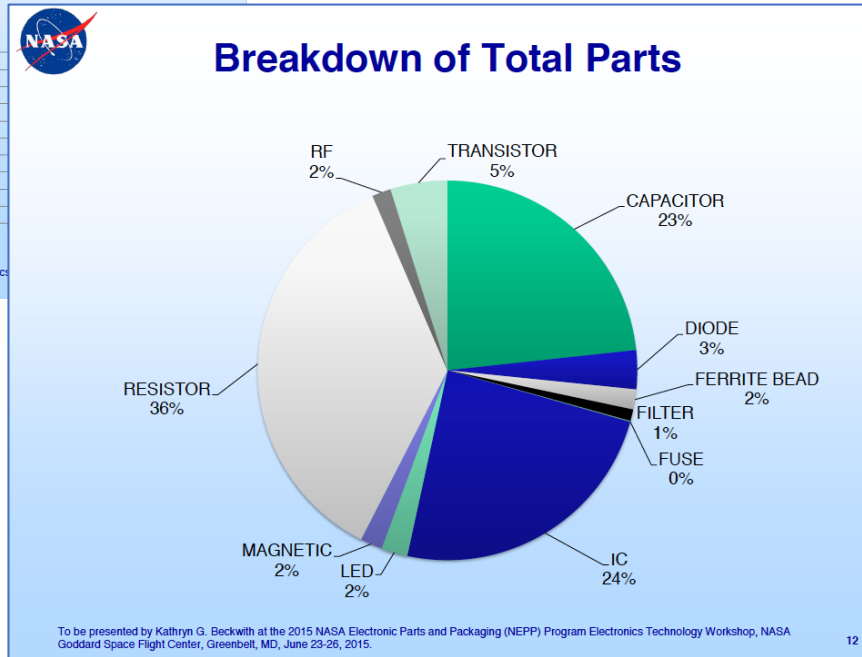
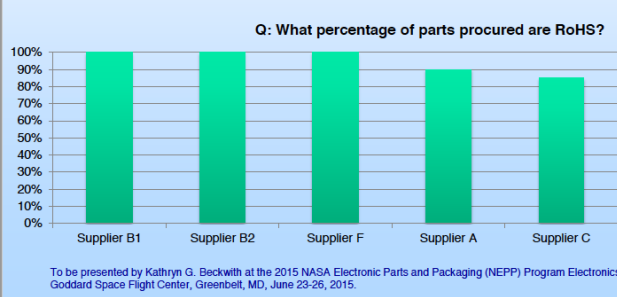
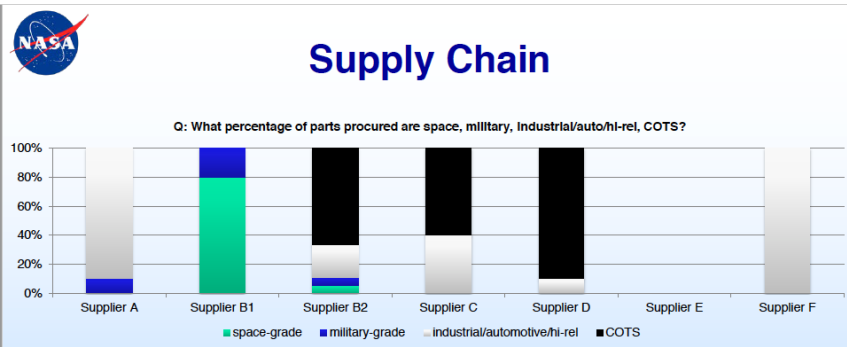
- **2016-2017 (Sundgaard)**

- Continued and expanded:
  - EEE Parts database for usage on NASA Smallsat missions
  - Survey of suppliers
    - 12 vendors, quantitative rankings

- **2018 (Mattmann et. al.)**

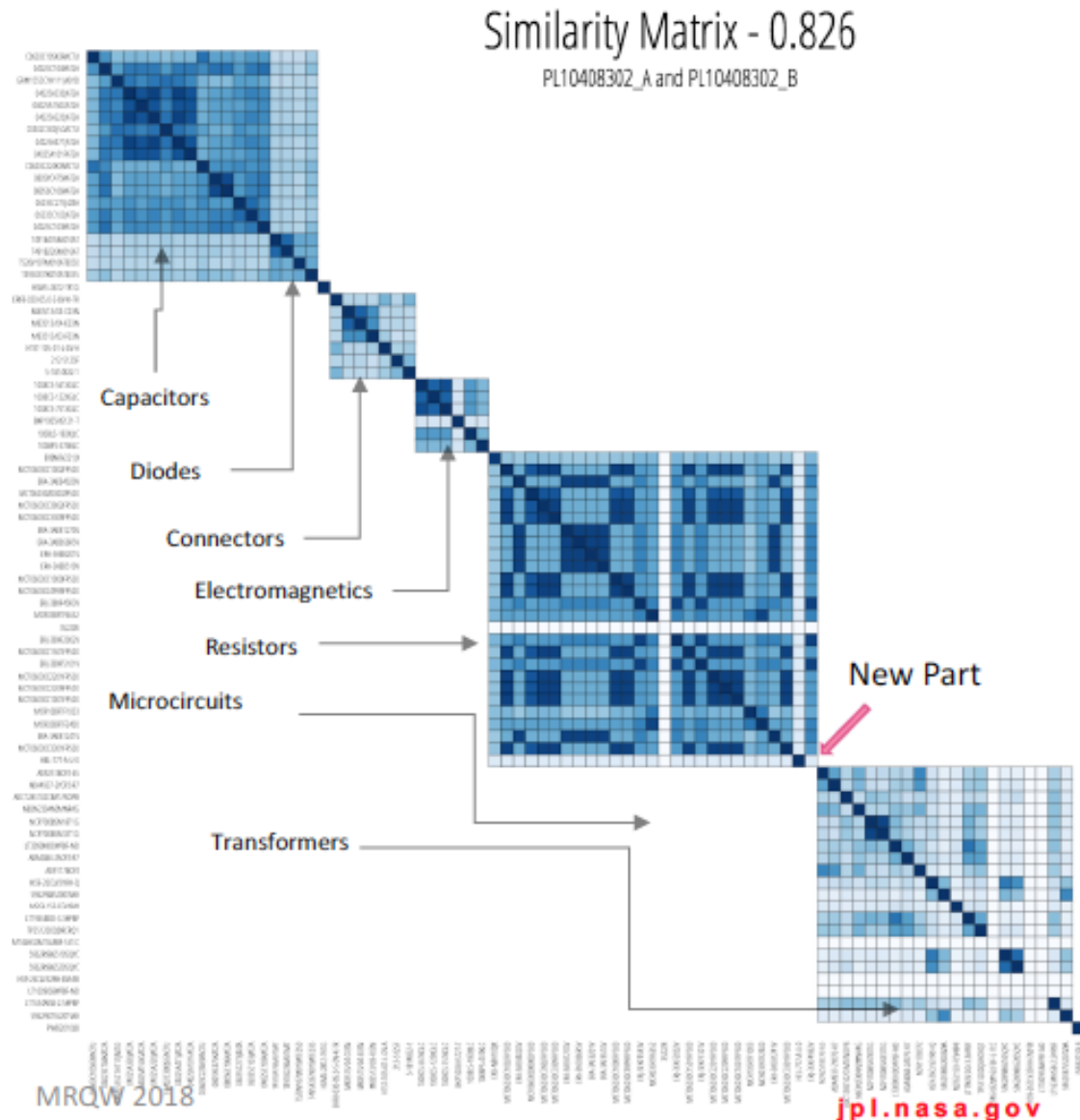
- Formal data science techniques & methodologies applied to broad range of data sources

# Results of historical Small Sat Supplier Task



# Cosine Similarity – Parts List Revision

- **Similarity matrix for two part lists**
- **Coloring indicates strength of similarity:**
  - 0 – white (no similarity)
  - 1 – dark blue (identical)
- **Diagonal of 1's is an artifact of comparing different revisions of the same part list**
  - One-off in diagonal indicates addition of a **new part**
- **Distinct regions correspond to part types**
  - Part comparisons are not made between different part types
- **Manage subtle changes in part type, provide an precise definition of “Heritage” as way to reduce risk**



# End Game: Pilot

- Situational Awareness of Vendor / Startup space in Small Sats related to parts used in Missions
- Better exploratory metrics
  - Cosine similarity, but also other feature similarities
    - Explore Jaccard, Edit Distance, etc.
  - Clustering techniques, similar parts, vendors, and relationships
  - Ranking algorithms for exploring vendor space and parts
- Ultimate Goal: better understanding of supply chain as it relates to our missions



# Thanks!

JPL Small Sat Data Science Team